WHAT IS CLAIMED IS:

1. An exposure apparatus for sequentially performing exposure of device patterns provided in a pattern effective area of a photo-mask on to shot areas of a wafer, comprising:

an illumination unit for collectively illuminating the entire pattern effective area of said photo-mask contained within the illumination range with exposure light;

a mask stage that moves said photo-mask for said illumination range in the mask scanning direction;

a wafer stage that moves said wafer for the projection range in which the pattern effective area of said photo-mask is projected in the wafer scanning direction; and

control means for, after containing at least one shot area of said wafer within said projection range to get device patterns provided in the pattern effective area of said photo-mask on to said one shot area of said wafer, synchronizing and controlling the movements of said mask stage and said wafer stage while keeping the entire pattern effective area of said photo-mask contained within said illumination range.

2. The exposure apparatus according to claim 1, wherein said wafer stage moves at a constant velocity or at a substantially constant velocity thereby keeping

a plurality of shot areas of said wafer contained sequentially within said projection range.

3. The exposure apparatus according to claim 2,

wherein said illumination unit comprises a laser light source that emits pulse light, and

said laser light source emits pulse exposure light at least once to perform exposure of device patterns provided in the pattern effective area of said photo-mask on to one of the shot areas of said wafer.

4. The exposure apparatus according to claim 3, further comprising:

a projection lens for projecting the pattern effective area of said photo-mask on to said projection range,

wherein said control means keeps the entire pattern effective area of said photo-mask contained within the field of view range of said projection lens while synchronizing and controlling the movements of said mask stage and said wafer stage.

5. The exposure apparatus according to claim 4,

wherein the exposure apparatus satisfies the relationship:

$$D \geq ((Ma + Mb)^2 + Md^2)^{1/2}$$

where,

Ma: Length of the pattern effective area of said photo-mask pattern in the mask scanning direction

Mb: Amount of movement of said photo-mask in said mask scanning direction when exposure is performed on to one of the shot areas of said wafer

Md: Width of said photo-mask

D: Diameter of the field of view range.

6. The exposure apparatus according to claim 4, wherein the exposure apparatus satisfies the relationship:

$Ta \leq (Wa - Wb)/V$

where,

Ta: Time after exposure of one shot area of said wafer is completed, then said mask stage is returned to the initial position in said mask scanning direction until synchronization is established with said wafer stage that has moved in said wafer scanning direction for an exposure on to the next shot area of said wafer

V: Moving velocity of said wafer stage

Wa: Length of one shot area of said wafer in said wafer scanning direction

Wb: Amount of movement of said wafer in said wafer scanning direction when exposure is performed on to one shot area of said wafer.

7. The exposure apparatus according to claim 4, wherein said mask stage is returned to an initial position for every one row or one column of consecutive shot areas of said wafer, and

the time for returning to the initial position is shorter than the time for movement for changing the row or column of said wafer stage in order to move to the next shot area.

8. The exposure apparatus according to claim 4, wherein said illumination unit comprises an illumination sensor to determine whether a predetermined amount of exposure has been reached or not, and terminates pulse emission of said laser light source when the total amount of exposure of said illumination sensor has reached the predetermined amount of exposure.

9. The exposure apparatus according to claim 4, further comprising:

voltage measuring means for measuring an applied voltage of said laser light source;

gas concentration measuring means for measuring gas concentration in the chamber of said laser light source; and

storing means for storing a light emission history of said laser light source as data,

wherein said laser light source calculates total exposure energy based on information of any one of or a combination of measurement results of said voltage measuring means and gas concentration measuring means or said light emission history data and controls based

on said calculation result so that the next pulse emission reaches predetermined exposure energy.

10. The exposure apparatus according to claim 4,

wherein said illumination unit comprises a micro mirror array for adjusting exposure energy in the light path, and

said micro mirror array is controlled based on information of any one or a combination of said illumination sensor, said voltage control means, said gas concentration measuring means and said light emission history data so that pulse light emission reaches predetermined exposure energy.

11. The exposure apparatus according to claim 4, wherein one or a plurality of device patterns is provided in the pattern effective area of said photomask.

12. The exposure apparatus according to claim 4,

wherein the pulse light emission count for one shot area of said wafer is controlled under the relationship of $I \cdot S/(J \cdot P)$

where,

I: Amount of required exposure per unit area

S: Area of one shot area of said wafer

J: One-time pulse light emission energy from said laser light source

P: Transmittance for light of exposure wavelength from said laser light source to said wafer.

~~13~~. A semiconductor device manufacturing method, comprising the steps of:

installing a plurality of semiconductor manufacturing apparatuses including an exposure apparatus in a factory; and

manufacturing semiconductor devices using said plurality of semiconductor manufacturing apparatuses,

wherein said exposure apparatus for sequentially performing exposure of device patterns provided in a pattern effective area of a photo-mask on to shot areas of a wafer comprises:

an illumination unit for collectively illuminating the entire pattern effective area of said photo-mask contained within the illumination range with exposure light;

a mask stage that moves said photo-mask for said illumination range in the mask scanning direction;

a wafer stage that moves said wafer for the projection range in which the pattern effective area of said photo-mask is projected in the wafer scanning direction; and

control means for, after containing at least one shot area of said wafer within said projection range to perform exposure of device patterns provided in the

pattern effective area of said photo-mask on to said one shot area of said wafer, synchronizing and controlling the movements of said mask stage and said wafer stage while keeping the entire pattern effective area of said photo-mask contained within said illumination range.

14. The semiconductor device manufacturing method according to claim 13, further comprising the steps of:

connecting said plurality of semiconductor manufacturing apparatuses via a local area network;

connecting said local area network and an external network outside said factory;

acquiring information on said exposure apparatus from a database on said external network using said local area network and said external network; and

controlling said exposure apparatus based on the acquired information.

15. A semiconductor manufacturing factory, comprising:

a plurality of semiconductor manufacturing apparatuses including an exposure apparatus;

a local area network that connects said plurality of semiconductor manufacturing apparatuses; and

a gateway that connects said local area network and an external network outside said semiconductor manufacturing factory,

wherein said exposure apparatus for sequentially performing exposure of device patterns provided in a pattern effective area of a photo-mask on to shot areas of a wafer comprises:

an illumination unit for collectively illuminating the entire pattern effective area of said photo-mask contained within the illumination range with exposure light;

a mask stage that moves said photo-mask for said illumination range in the mask scanning direction;

a wafer stage that moves said wafer for the projection range in which the pattern effective area of said photo-mask is projected in the wafer scanning direction; and

control means for, after containing at least one shot area of said wafer within said projection range to perform exposure of device patterns provided in the pattern effective area of said photo-mask on to said one shot area of said wafer, synchronizing and controlling the movements of said mask stage and said wafer stage while keeping the entire pattern effective area of said photo-mask contained within said illumination range.

~~16.~~ A maintenance method for an exposure apparatus, comprising the steps of:

preparing a database for storing information on the maintenance of said exposure apparatus on an external network outside the factory in which said exposure apparatus is installed;

connecting said exposure apparatus to a local area network in said factory; and

performing maintenance of said exposure apparatus based on information stored in said database using said external network and said local area network,

wherein said exposure apparatus for sequentially performing exposure of device patterns provided in a pattern effective area of a photo-mask on to shot areas of a wafer comprises:

an illumination unit for collectively illuminating the entire pattern effective area of said photo-mask contained within the illumination range with exposure light;

a mask stage that moves said photo-mask for said illumination range in the mask scanning direction;

a wafer stage that moves said wafer for the projection range in which the pattern effective area of said photo-mask is projected in the wafer scanning direction; and

control means for, after containing at least one shot area of said wafer within said projection range to perform exposure of device patterns provided in the

pattern effective area of said photo-mask on to said one shot area of said wafer, synchronizing and controlling the movements of said mask stage and said wafer stage while keeping the entire pattern effective area of said photo-mask contained within said illumination range.